(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
21 December 2000 (21.12.2000)

PCT

(10) International Publication Number
WO 00/77440 A1

(51) International Patent Classification[7]: F16L 47/00, 41/00, 33/00

(21) International Application Number: PCT/TR99/00028

(22) International Filing Date: 15 June 1999 (15.06.1999)

(25) Filing Language: English

(26) Publication Language: English

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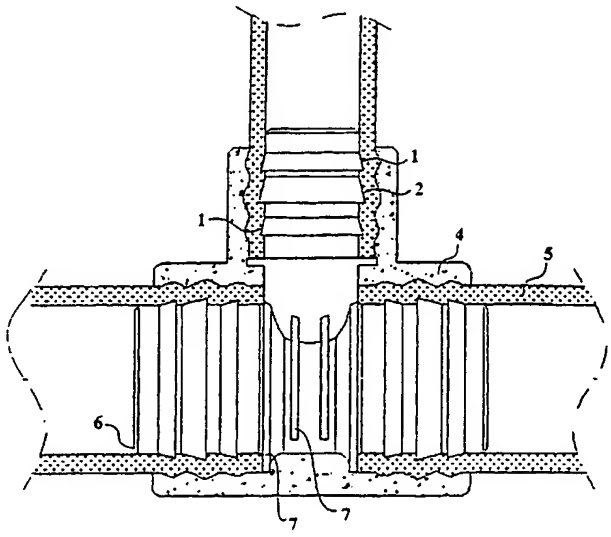
(81) Designated States *(national)*: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: HOSE CONNECTION PART



(57) Abstract: The connection part formed to connect two or more flexible hoses (5), is made of rigid plastic material containing glass fibre reinforcement. At least three ribs (1 and 2) with rounded tips and having a circular structure to encircle the siphons are arranged on each siphon. In order to avoid a turbulence and a decrease in the flowrate of the fluid that may occur due to the friction between the fluid and the connection part, and further to avoid a penetration of the fluid to a zone between the connection part and the hose ends, the inner section of the connection part end (6) is inclined upwards at an angle greater that 45°. No gaps nor barriers that may hinder the passage of the fluid are left between the connection part and the hose (5) due to the said inclined structure. By applying the injection pressure above 130 bars, a secure fixation of the flexible hose (5) ends to the connection part, is obtained.

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HOSE CONNECTION PART

The present invention is related to providing a reliable and long term usage of the connection parts of the hoses for use in fluid circuits, being protected against external conditions.

Hoses of various diameters, lengths and forms are being used for providing the interconnection of such engine units as radiator, collector, radiator core, water pump, expansion tank at different positions and for converging the fluids. The said linking of these hoses with each other is provided by different connection parts produced by using different technologies. The hoses with several connections have a branched structure. In such hoses, the diameters of the secondary hoses may be equal or different as compared with the diameter of the main hosing.

The hoses and particularly the connection zones of the hoses have to be reliable. For this reason the constituent materials include reinforcing elements such as textile knit and other elements made of metal or plastics, in order to enhance the durability and strength of the hose structure. The weakest points in the hoses against external, environmental impacts are the connection zones.

From the disconnections due to any reason (static or dynamic pressure, temperature, etc) the fluid conveyed by the hose may leak out.

One of the connection parts developed in order to eliminate the above mentioned problems, is disclosed in the German Patent No. 03430053; according to which a

rigid pipe, which is usually metallic, is inserted as the connecting part, inside the hose by enlarging the end section of the hose.

In the US Patent No. 5125693, circumferential grooves with of rectangular section are formed at the ends of the flexible hoses before the plastic injection process, that is to say, during the vulcanisation of the hoses. However, this formation of the grooves is very difficult. Moreover, a connecting part comprising ribs of the same height arranged successively with no space or plane area in between, is used.

As described in the EP No. 0110102 , a duplicate moulding is used in order to prevent the risks of disconnection or probable leaks. However the implementation of this method for branched hoses raises numerous difficulties.

In the US Patent No. 5033775 wherein another technique is disclosed, the ribs formed on the connection part inserted inside the flexible hose prevent the retraction of the hose. However as these ribs are of the same height, the flexible hose cannot be fixed secure enough to provide the sufficient retraction resistance. Furthermore, the ribs designed as having sharp corners in this patent substantially increase the risk of damaging the inner tubes of flexible hose connected on the siphons of the connecting part and thus the risk of leakage. In the same technique, as the end of the connection part that is inserted inside the hose does not make an angle at its inlet clearance, the friction surface is increased and therefore the flow rate of the fluid passing through the hose is reduced; and additionally it enhances the risk of pressurized fluid penetration between the connection piece and the inner tube of the hose.

An adhesive is applied between the inner surface of the hose ends and the outer surface of the connection part siphon, in order to prevent the hose from being disconnected from the connection piece. In this case, foreign substances and particles may be found in the cooling water circuit.

In the present practices there is no proof that the overmoulding sleeve injected under high pressure provides a very strong compressive action and in connection with this, that the flexible hose ends attached to the connection part exhibit a resistance without being subject to a permanent deformation under this high pressure, still maintaining their flexible characteristics. The pressure values used in general are between 80 and 85 bars whereas the permanent deformation values vary between 80 to 100% ; where the latter has been obtained during the test performed according to DIN 53516 norm.

The object of the present invention is to provide a reliable and long term usage of the hoses and hose connections providing the fluid circuit, against all kinds of inner and outer impacts.

The hose connection part realized in order to achieve the above mentioned object of the present invention is illustrated in the attached drawings, wherein;

Figure 1 is the general side view of the hose connection part, with the ends calibrated, flexible hose mounted and the outer overmoulding sleeve injected;
Figure 2- shows the cross section view of the hose connection part;
Figure 3- shows the cross-section side view of the hose connection part;
Figure 4- shows cross section views of the hose connection part, with the ends calibrated, flexible hose mounted and the outer overmoulding sleeve injected.

The components shown on the drawings are numerated and these numerals refer to the below listed components;

1. Rib
2. High Rib
3. Abutting surface (horizontal)
4. Overmoulding sleeve

5. Flexible Hose
6. Connection Part End
7. Pipe Rib
8. Neck portion
9. Abutting surface (vertical)
10. Radial blend

The connection part formed to connect two or more flexible hoses (5) is made of rigid plastics that may be reinforced with glass fibre. The connection part is made in T or Y or X form.

Each siphon on the connection part has at least three ribs (1 and 2) with a circumferential structure so that they can encircle the siphons. These ribs (1 and 2) have lateral surfaces that are slightly inclined outwards and a structure that cuts the connection part vertically. The said lateral surfaces of the ribs contact with the connection part by a slight inclination. The heights of these ribs which are preferably three in number, are different with regard to each other. Furthermore, the distance between these ribs (1 and 2) are also different. In case there exist three ribs on the connection part, the first and the third ribs (1) are of the same height and the intermediary rib (2) is higher. If there are two ribs (1 and 2) on the piece, the second rib (2) is higher than the first one (1). More over the tips of the ribs are rounded in order to fillet their sharpness. As the plastic material is injected as an undulated surface, the ribs (1 and 2) formed at different heights and intervals prevent any damages such as tear-off and the like that may occur on the flexible hose (5) which is compressed between the overmoulding sleeve and the ribs (1 and 2) due to their rounded tips and they also provide a faster and more secure fixation of the hose to the connection part.

A surface that prevents the easy passage of the fluid passing through the hose (5), while entering the connection part due to the difference between the inner diameter of the hose (5) and that of the connection part is created and this surface

may cause the penetration of the fluid into the area between the hose (5) and the connection part.

In order to prevent a decrease in the flowrate of the fluid that may occur due to the friction between the fluid and the connection part, the inner part of the end of the connection part (6) is inclined upwards at an angle greater than 45°.

Due to this inclined structure, there are no gaps, and no barriers left between the connection part and the hose (5) to prevent the passage of the fluid.

On the intermediary section of the connection part, ribs (7) with circumferential structure that join to the neck portion (8) of the connection part in order to prevent any torsions or deviations that may occur at the connection part during plastic injection, wherein the sections connecting with the edges of the said neck portion (8) form a full hoop, are formed between them. The ribs (7) at the edges are connected to the siphon with a certain radius in order to prevent their breaking. A blended transition is formed at the location where the neck portion (8) and the above mentioned ribs (7) are joined in order to reinforce the endurance of the connection part.

At the upper zone of the said neck portion (8) an abutting surface (3) has been formed, projecting outward from the surface. The hose (5) rests upon the abutting surface (3) and on the other abutting surface (9) formed on the outer surface of the pipe ribs (7), between the abutting surface (3) and the neck portion (8), the other hose (5) is placed.

Thus, as abutting surfaces (3,9) are positioned in different ways after the hoses (5) are connected to the connection part, the said hoses (5) do not contact with each other and the gaps remained between them, are filled with plastic injection in order to fix the hose in a more secure way. Furthermore, as the circular zone at the connection point of the third hose (5) and the main body has been transformed

to a plane as the extension of the abutting surfaces (9) at the ribs (7), the distance between two hoses is reduced and thus material saving has been made.

During the vulcanisation of the flexible hoses (5) the ends of these hoses are calibrated by applying pressure using the end-moulding method. As the result of this process, the diameter and wall thickness at the hose (5) ends is made homogeneous, and thus the inner diameter and wall thickness of the hose (5) is held at narrow tolerance limits, the overmoulding sleeve gram-weight during injection process is formed with the desired precision, the overmoulding sleeve applies a compression with a permanently homogeneous force on the flexible hoses (5) and the spilling of the injection material out of the mould is prevented.

The flexible hoses (5) are prepared in advance using a two stage, peroxide cure mixture in order to avoid any plastic deformation and to maintain the elastic properties such as sealing and damping against the high injection pressure generated during the formation of the overmoulding sleeve.

By applying an injection pressure above 130 bars, a secure fixation of the flexible hose (5) ends on the connection part is obtained. Moreover, a ribbed surface with a varying amplitude is formed between the outer surface of the flexible hose ends (5) and the inner surface of the overmoulding sleeve adjacent to this surface which cooperates with the ribs (1 and 2) to compress the flexible hose (5) ends between the overmoulding sleeve and connection part, in order to avoid the loosening or slipping of the connection part on which the flexible hose (5) ends are connected, due do harsh operating conditions of the motor cabin.

The connection parts are prepared as primary siphons with a nominal outer diameter of ϕ32 mm and secondary siphons with a nominal outer diameter of ϕ18 mm.

The inner diameters of the connected flexible hoses (5) at their end-moulding zones, are 1 mm smaller than those of the opposite parts (siphons). The average permanent deformation value of the hoses (5) is 40% according to DIN 53516 norm and the recorded maximum injection pressure value is 134 bars. Later, these connection parts are subjected to a pulsating pressure test with 500.000 cycles. The pressure value varies between the values , P_{min}= 0.1 bar and P_{max} = 3.0 bar and the pressure wave follows a sinus curve at 0.5 Hz frequency. Additionally, the fluid temperature is 135^0C.

Following the pulsating pressure test with 500.000 cycles, an X-Ray inspection has been performed in order to examine the sectional areas of the connection zones, without any damage.

No loosening nor slippage is observed with regard to the initial positioning of the ends of the flexible hoses (5) which had originally been pushed up to the abutting surfaces (3 and 9) on the connection parts.

The pull off force required to retract the ends of the flexible hoses (5) from the location between the connection part and the outer overmoulding sleeve where they are connected, is measured by using a tensometer. The values thus obtained are in the range of 1,310 N and 1,450 N i.e. an average value of 1,395N for the primary hoses, and in the range of 1,030N and 1,120 N, i.e. an average value of 1,0.68 N for the secondary hoses.

CLAIMS

1. A hose connection part that provides a secure fixation of the hose (5) on the connection part, having a slightly inclined lateral surface on each branch of the connection part so that it encircles the said branches and a circular structure that intersects with the connection part vertically, wherein the said lateral surfaces are in contact with the connection part due to the slight inclination given to them, characterized with at least three ribs provided on each branch, the height and length of the intermediary rib (2) being different than the other two ribs (1), and the tips of the ribs (1 and 2) being rounded in order to avoid any damages that may occur on the inner tube of the flexible hose.

2. A hose connection part according to claim1, characterized in that the first and last of the three or more ribs (1) have the same height whereas the remaining ribs (2) are higher than the first and the last rib (1).

3. A hose connection part according to Claims 1 and 2, characterised with a connection part end (6) inclined upwards, at an angle greater than 0° in such a manner that no gaps are left between the connection part and the hose (5) to avoid the formation of a vertical surface which may be formed due to the fact that the inner diameter of the hose and the inner diameter of the connection part are different which in turn might cause the penetration and/or leakage of the fluid to a zone between the connection part and the hose (5)

4. A connection part according to Claims 1 to 3, characterized with circular ribs (7) that form a complete hoop at the lateral surface sections of the neck portion (8), being connected to the said neck portion (8) of the connection part in order to avoid a distortion and deflection that may occur on the middle section of the connection part during the plastic injection that is realised after the hose (5) is connected, that joins at a certain inclination with the siphon in

order to avoid a breaking, the gaps at the top section of which are left empty in order not to constitute an obstacle to the nozzle of the plastic injection.

5. A hose connection part according to Claims 1 to 4 characterized with an abutting surface (3 and 9) that is formed at the upper section of the neck portion (8) of the connection part, projecting outwards from the surface, which avoids the contact of the hose (5) with the other hose (5) placed at the zone in the neck portion (8) and which provides a more secure fixation of the hose (5) and the reduction of the connection zone volume, by filling in the gaps with plastic injection.

6. A hose connection part according to Claims 1 to 5, characterized with a radial blend formed at the connection point of the neck portion (8) and the siphons, on the outer surface of the connection part, in order to enhance the strength and durability of the connection part.

7. A hose connection part according to Claims 1 to 6, characterized with the circular ribs (7) formed at the connection point of the branches, at the neck portion (8) and the middle section of the connection part.

8. A hose connection part according to Claims 1 to 7, characterized in that the diameter and wall thickness at the hose (5) ends are made homogeneous, and thus the inner diameter and wall thickness of the hose (5) is held at narrow tolerance limits, the overmoulding sleeve gram-weight during injection process is formed with the desired precision, the overmoulding sleeve applies a compression with a permanently homogeneous force on the flexible hoses (5) and the spilling of the injection material out of the mould is prevented, and that the flexible hoses (5) are prepared in advance using a two stage, peroxide cure mixture in order to avoid any plastic deformation and to maintain the elastic properties such as sealing and damping against the high

injection pressure generated during the formation of the overmoulding sleeve.

9. A hose connection part according to Claims 1 to 8, characterized in that a ribbed surface with a varying amplitude is formed between the outer surface of the flexible hose ends (5) and the inner surface of the overmoulding sleeve adjacent to this surface, which cooperates with the ribs (1 and 2) to compress the flexible hose (5) ends between the overmoulding sleeve and connection part, in order to avoid the loosening or slipping of the connection part on which the flexible hose (5) ends are connected, due do harsh operating conditions of the motor cabin, and that the injection pressure providing a secure fixation of the flexible hose (5) ends on the connection part, is above 130 bars.

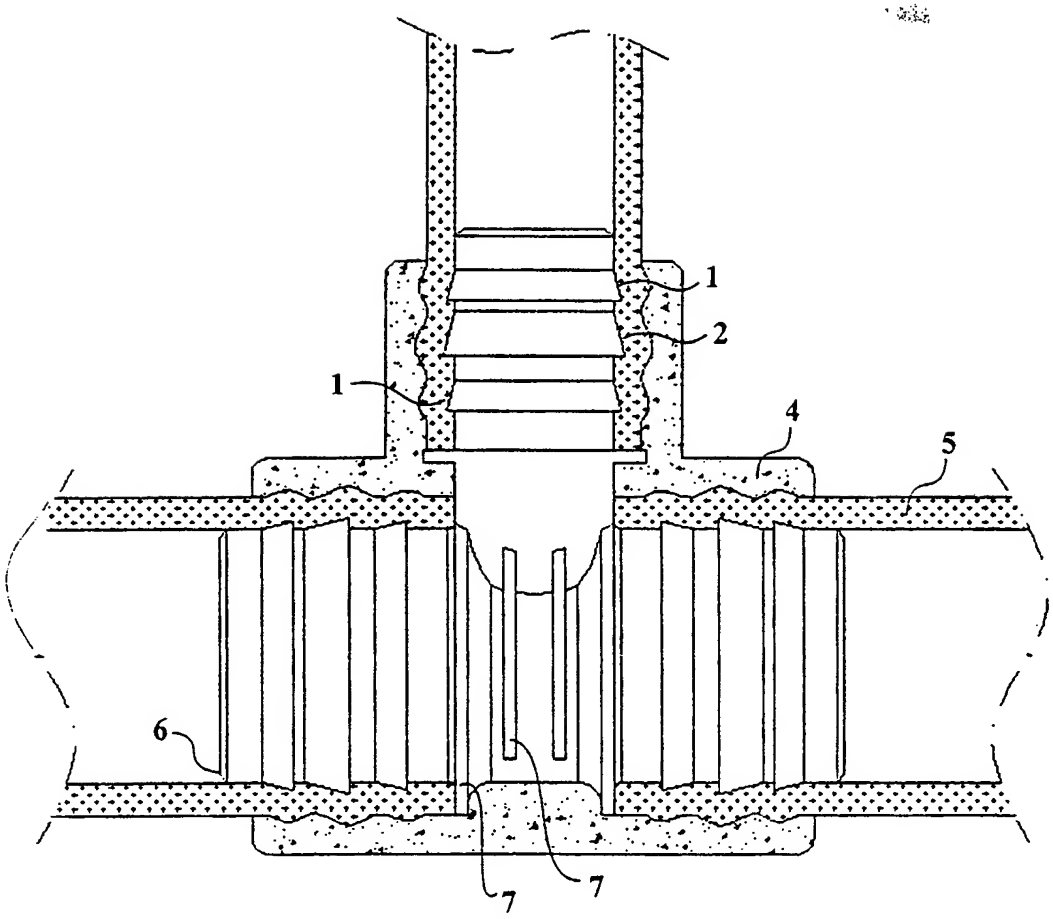


Figure-1

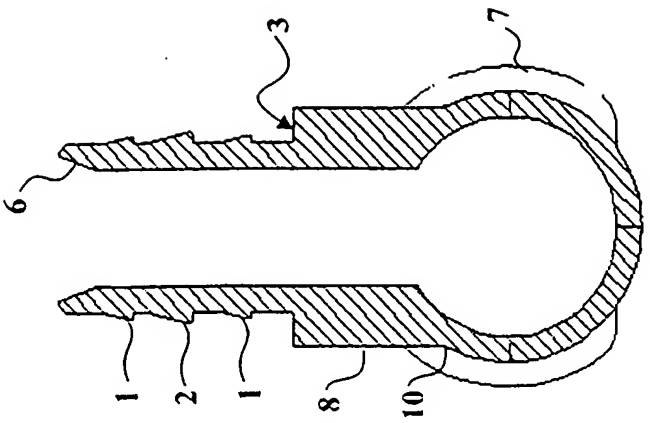
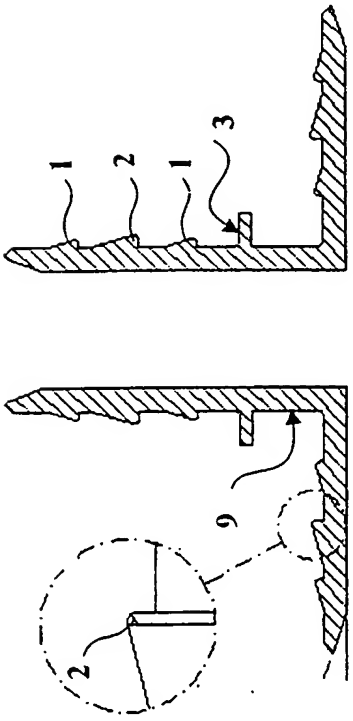


Figure-3



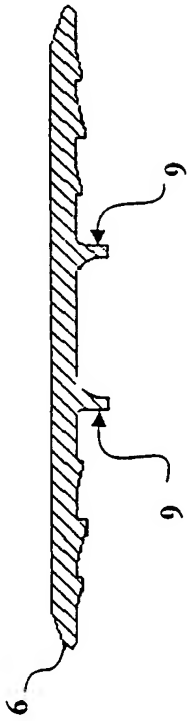


Figure-2

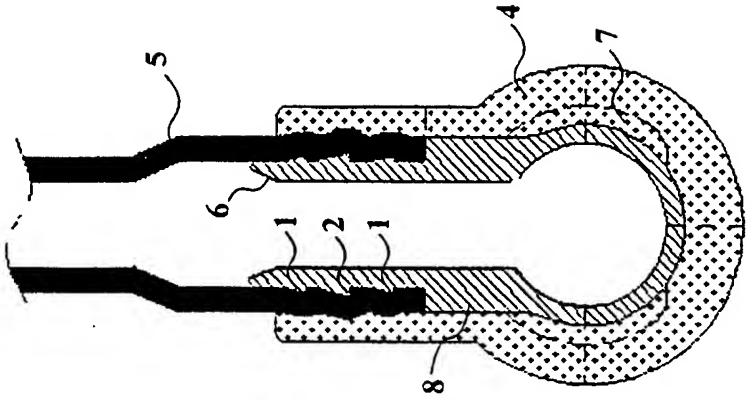


Figure-5

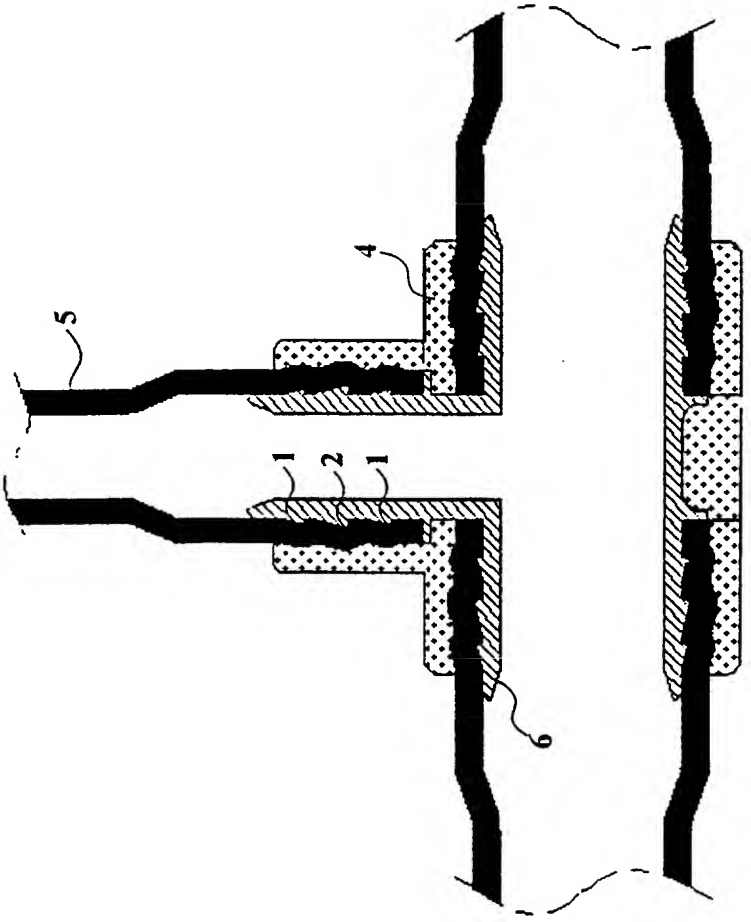


Figure-4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/TR 99/00028

A. CLASSIFICATION OF SUBJECT MATTER

IPC[7]: F 16 L 47/00, 41/00, 33/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[7]: F 16 L 31/00, 33/00, 33/01, 35/00, 39/00, 39/02, 41/00, 41/02, 47/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0564990 A1 (SAIAG INDUSTRIA S.P.A) 13 October 1993 (13.10.93), totality.	1,3,5,8,9
Y	US 5411300 A (MITSUI) 02 May 1995 (02.05.95), totality.	1,5,8,9
Y	US 5447341 A (HÄRTEL) 05 September 1995 (05.09.95), totality.	3,5,8,9

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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„A" document defining the general state of the art which is not considered to be of particular relevance
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„P" document published prior to the international filing date but later than the priority date claimed
„T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
„X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
„Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
„&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
05 October 1999 (05.10.99)	31 March 2000 (31.03.00)
Name and mailing adress of the ISA/AT Austrian Patent Office Kohlmarkt 8-10; A-1014 Vienna Facsimile No. 1/53424/200	Authorized officer Schuganich Telephone No. 1/53424/440

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/TR 99/00028

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